Samish River Watershed: Streamflow Variability, Water Use Depletion and Impacts on Fish Habitat

by

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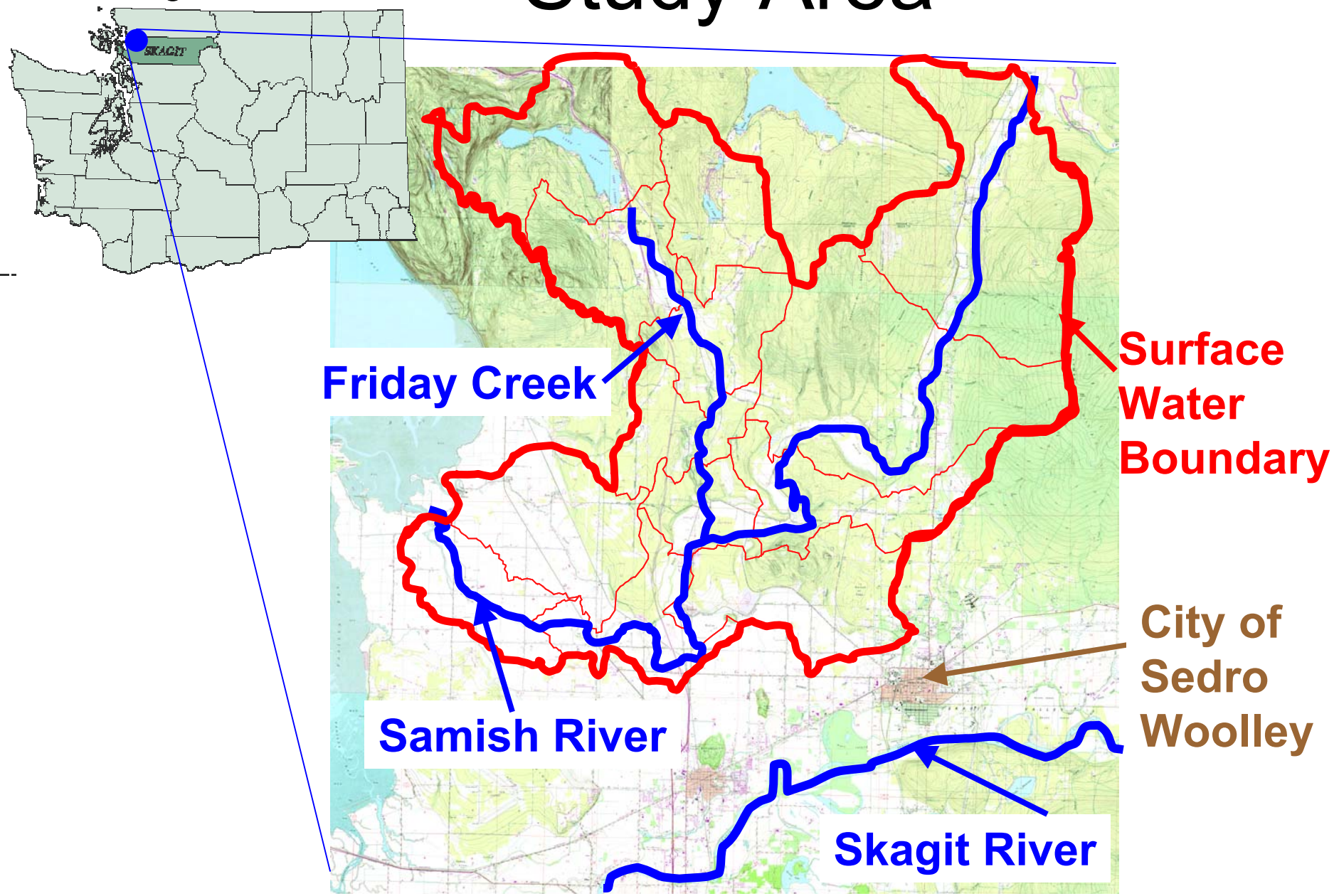
Purpose of Study

Minimum Instream Flow Rates

- Natural streamflow variability
- Water use impacts on streamflow
- Fish habitat requirements

Study Area


Washington State
SKAGIT
Friday Creek
Surface Water Boundary
Samish River
City of Sedro Woolley
Skagit River

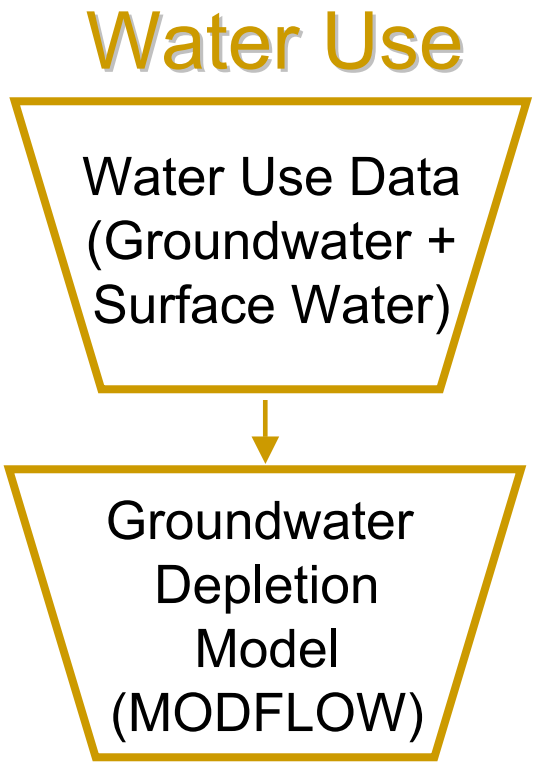
Upper Samish River

Lower Samish River

Project Components

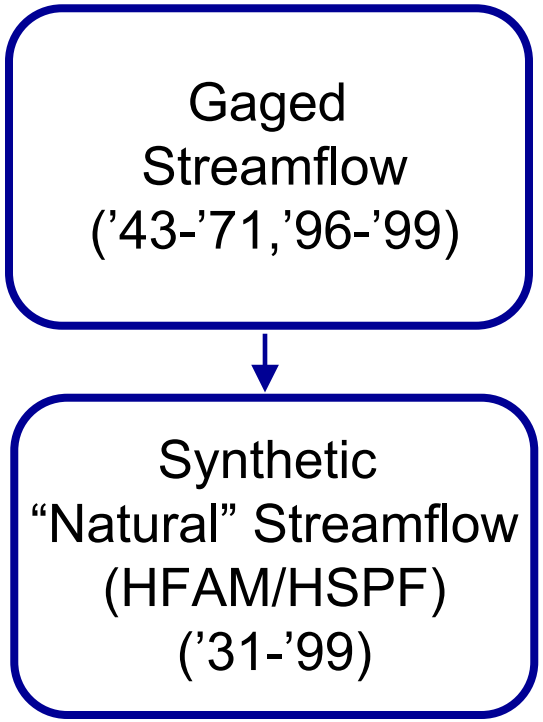
- Natural Streamflow Variability
- Water Use Evaluation
- Streamflow Depletion Impact Assessment
  - Surface and Groundwater Modeling
- Instream Fish Habitat Study

Process


Water Use
Water Use Data (Groundwater + Surface Water)
Groundwater Depletion Model (MODFLOW)

Process

Streamflow

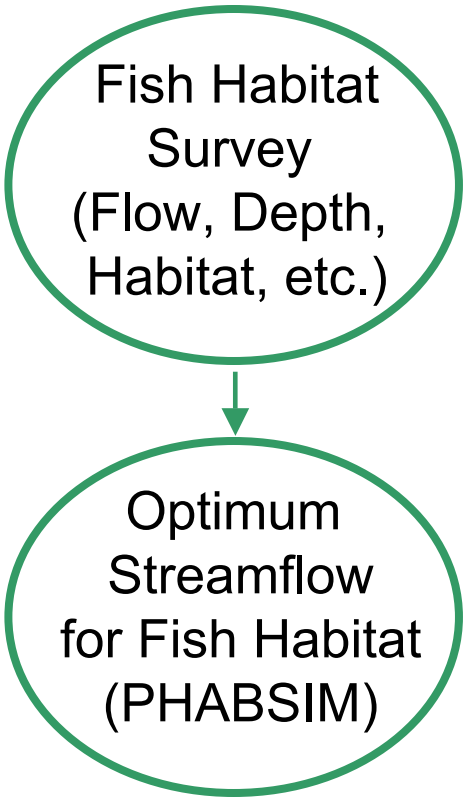


Process


Altered Streamflow
(Natural Flow – Depletion)
Depleted Streamflow

Process

Fish Habitat



Process

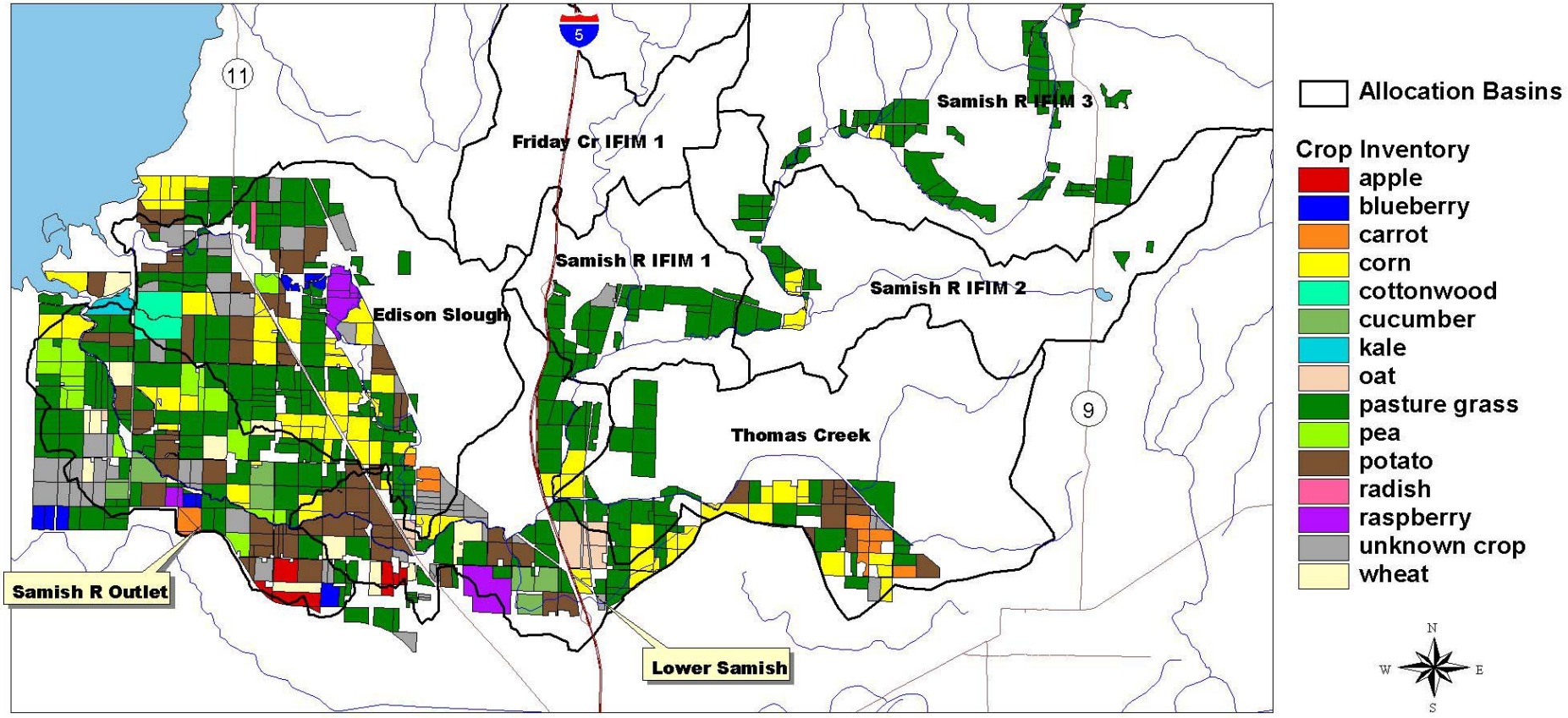
Instream Flow Recommendations

Water Use Inventory

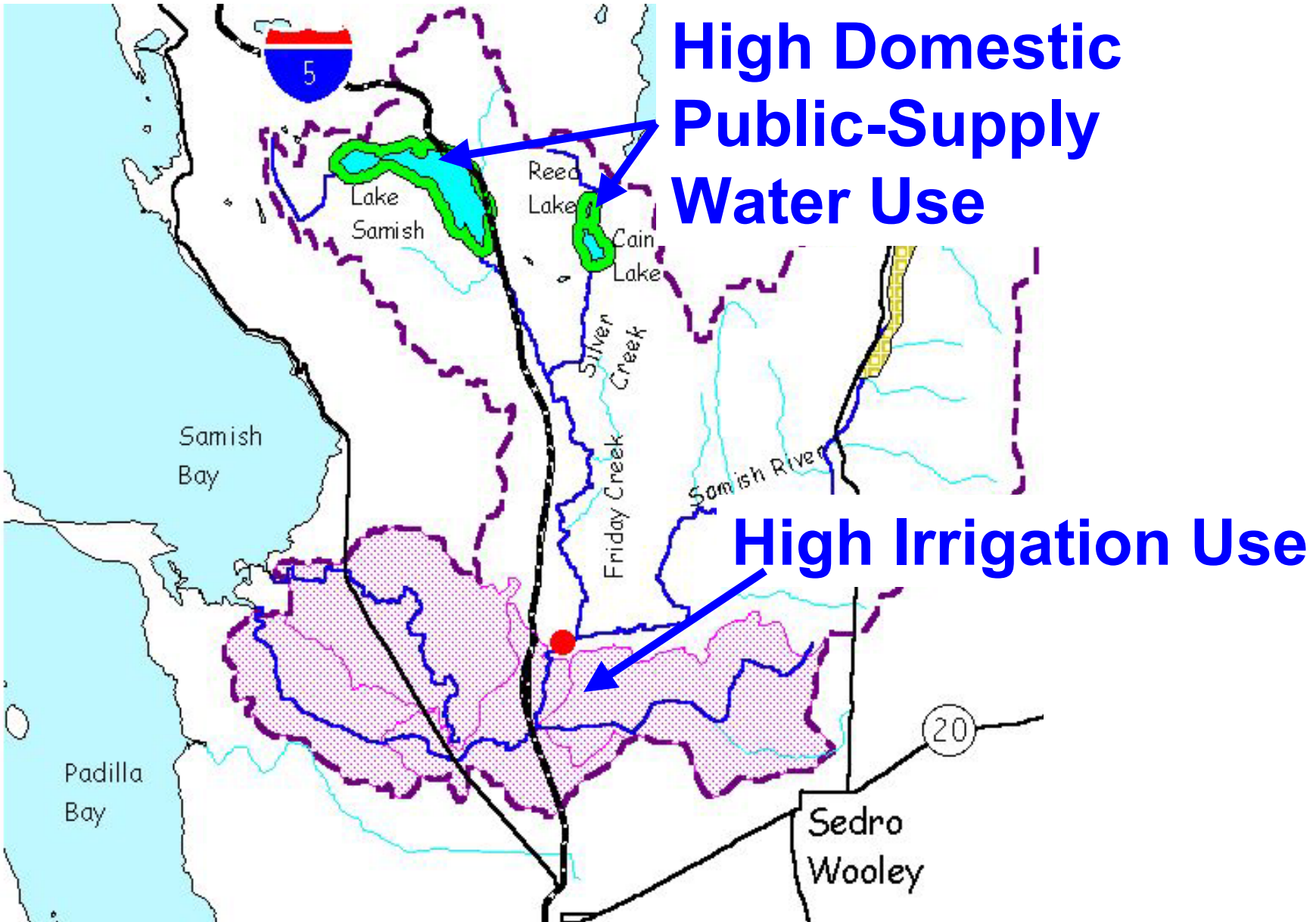
- Inventoried water use
  - Irrigation (Crop Requirement)
  - Public supply
  - Commercial/Industrial
  - Domestic exempt
- Water rights mapping
- Water use scenarios
  - Current consumptive use
  - Water rights entitlements
  - Future buildout

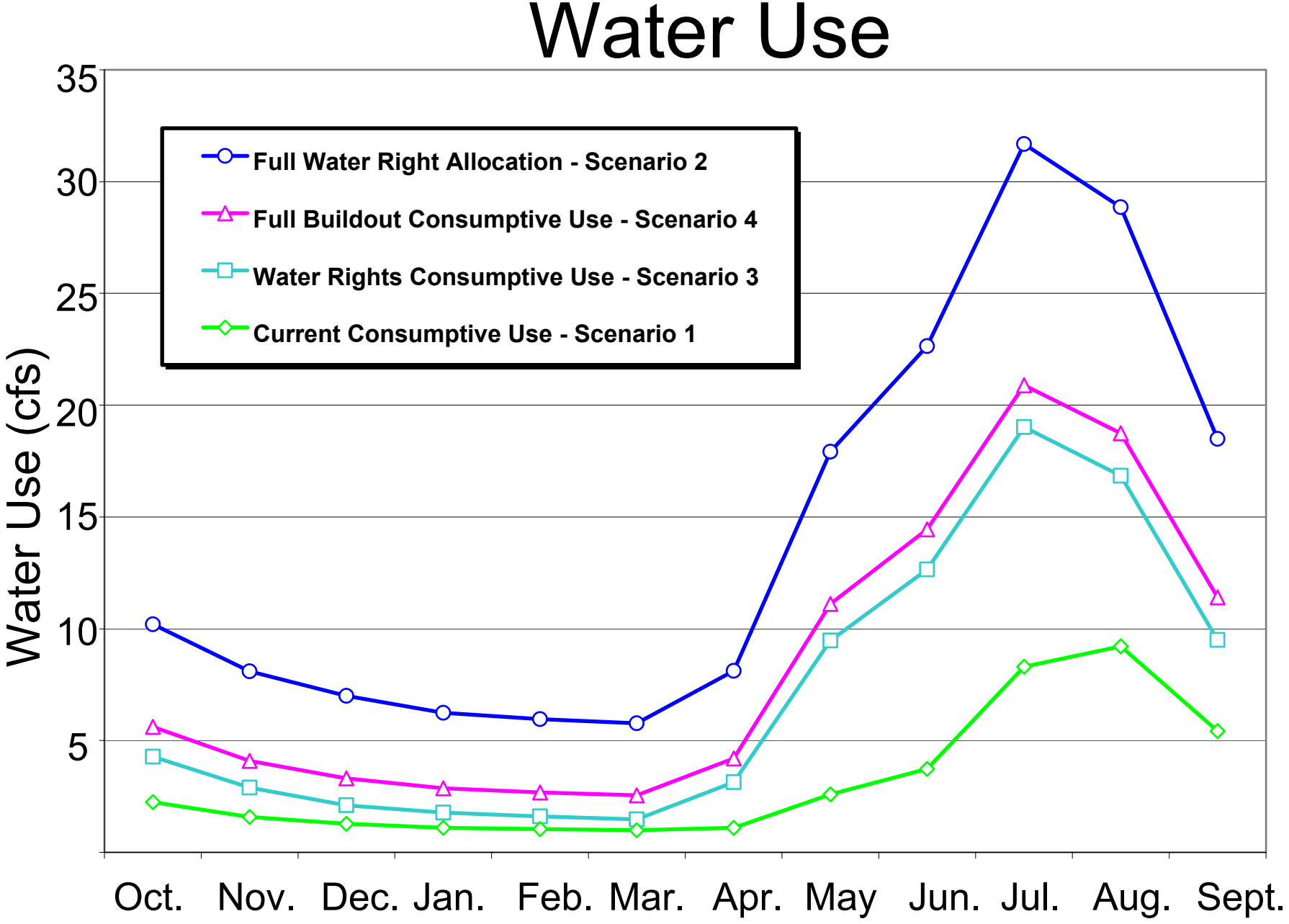
Water Use Inventory

Lower Samish Basins - Crop Inventory, August 2000

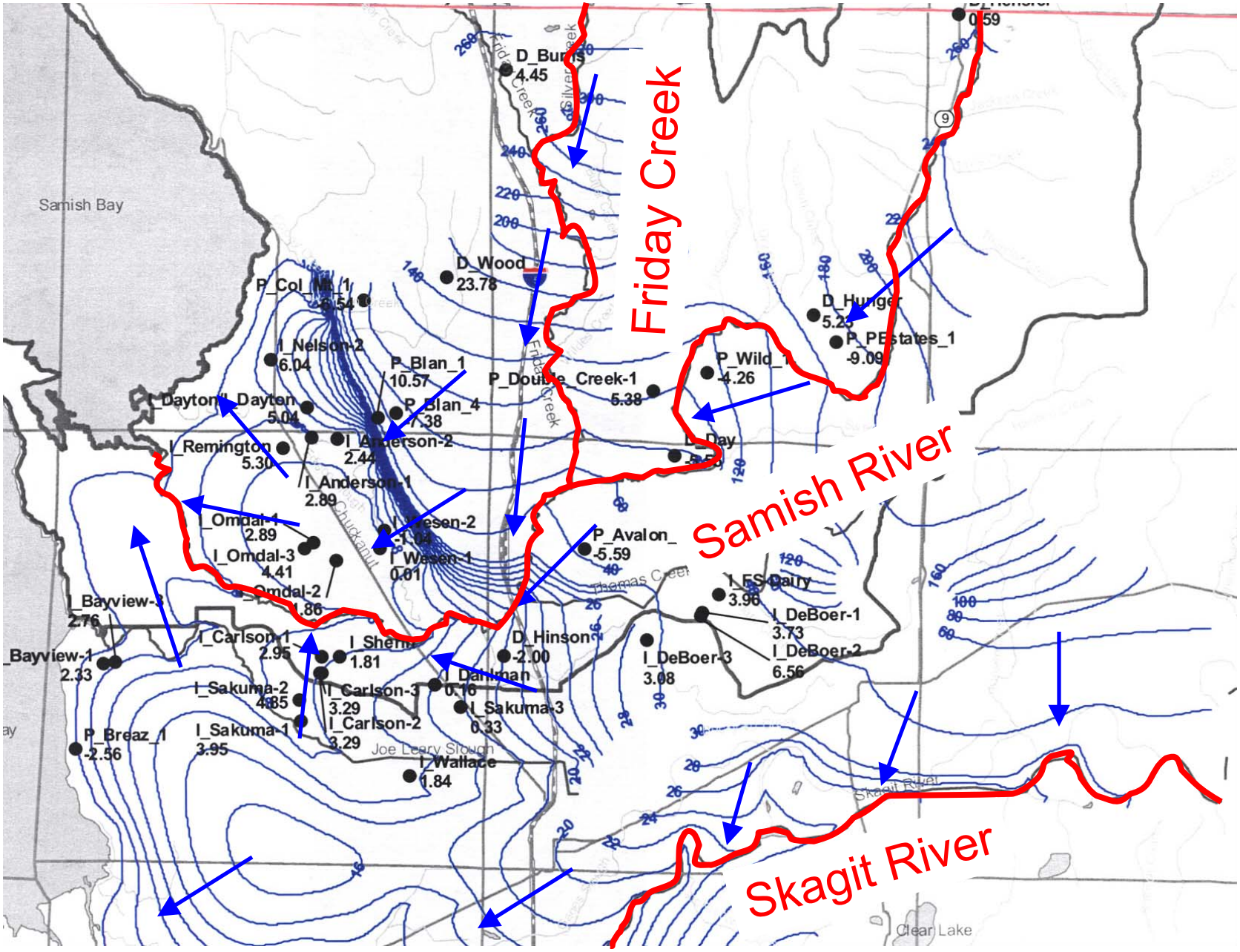


Water Use

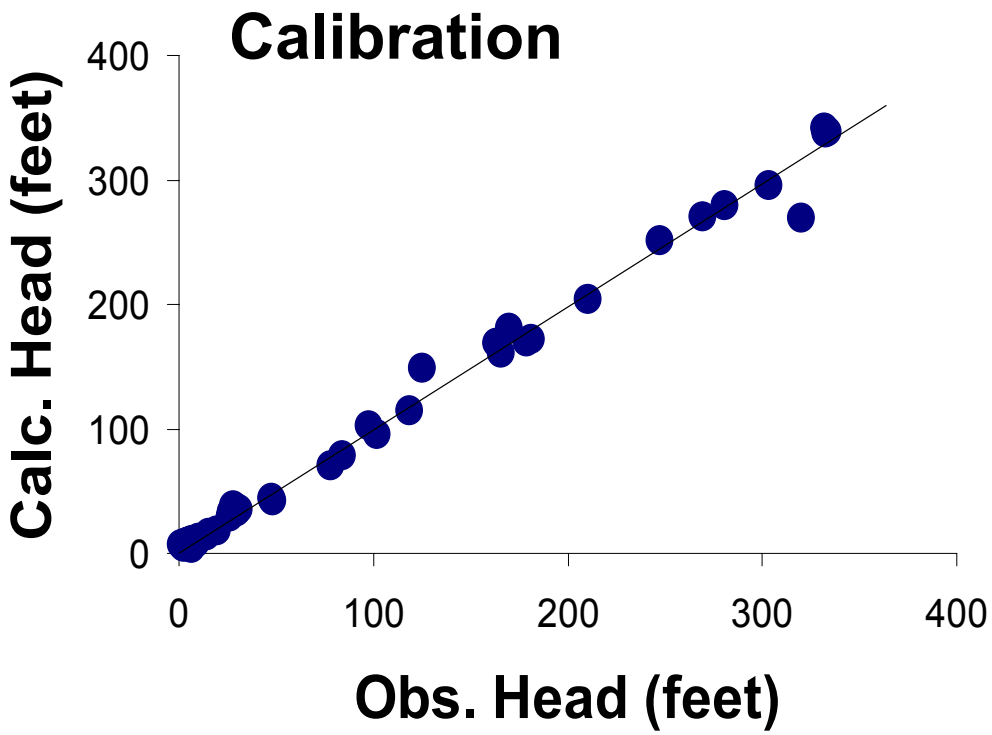

High Domestic Public-Supply Water Use
High Irrigation Use
5
Lake Samish
Reed Lake
Cain Lake
Silver Creek
Friday Creek
Samish River
Samish Bay
Padilla Bay
20
Sedro Wooley


Water Use
Water Use (cfs)
35
30
25
20
15
10
5
Full Water Right Allocation - Scenario 2
Full Buildout Consumptive Use - Scenario 4
Water Rights Consumptive Use - Scenario 3
Current Consumptive Use - Scenario 1
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sept.

Ground Water Model



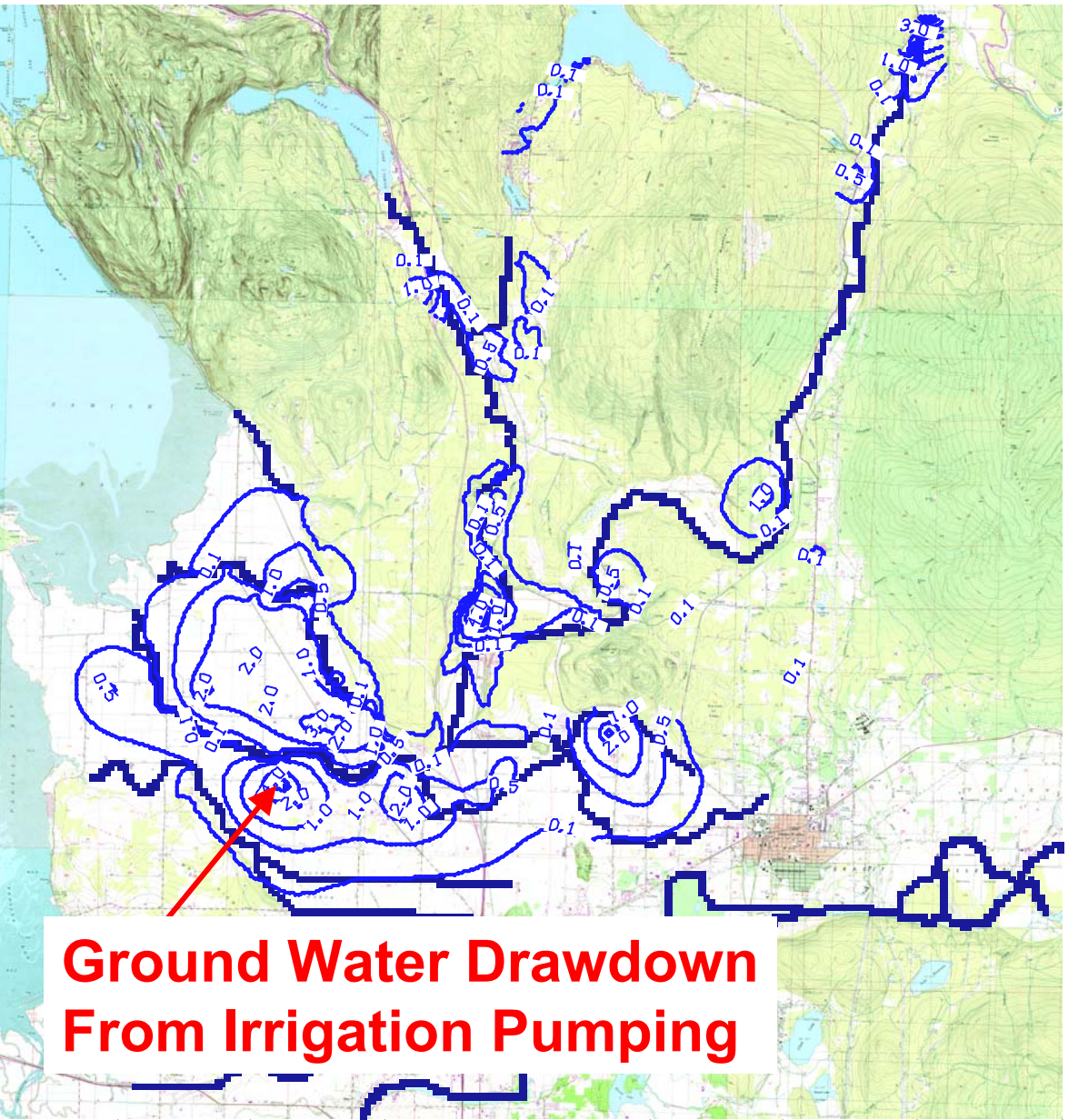
Ground Water Model



Ground Water Model

- Calibrated to static and transient conditions
- Used data from municipal supply and irrigation wells
- MODFLOW (300 mi.^{2}, 4 layers)

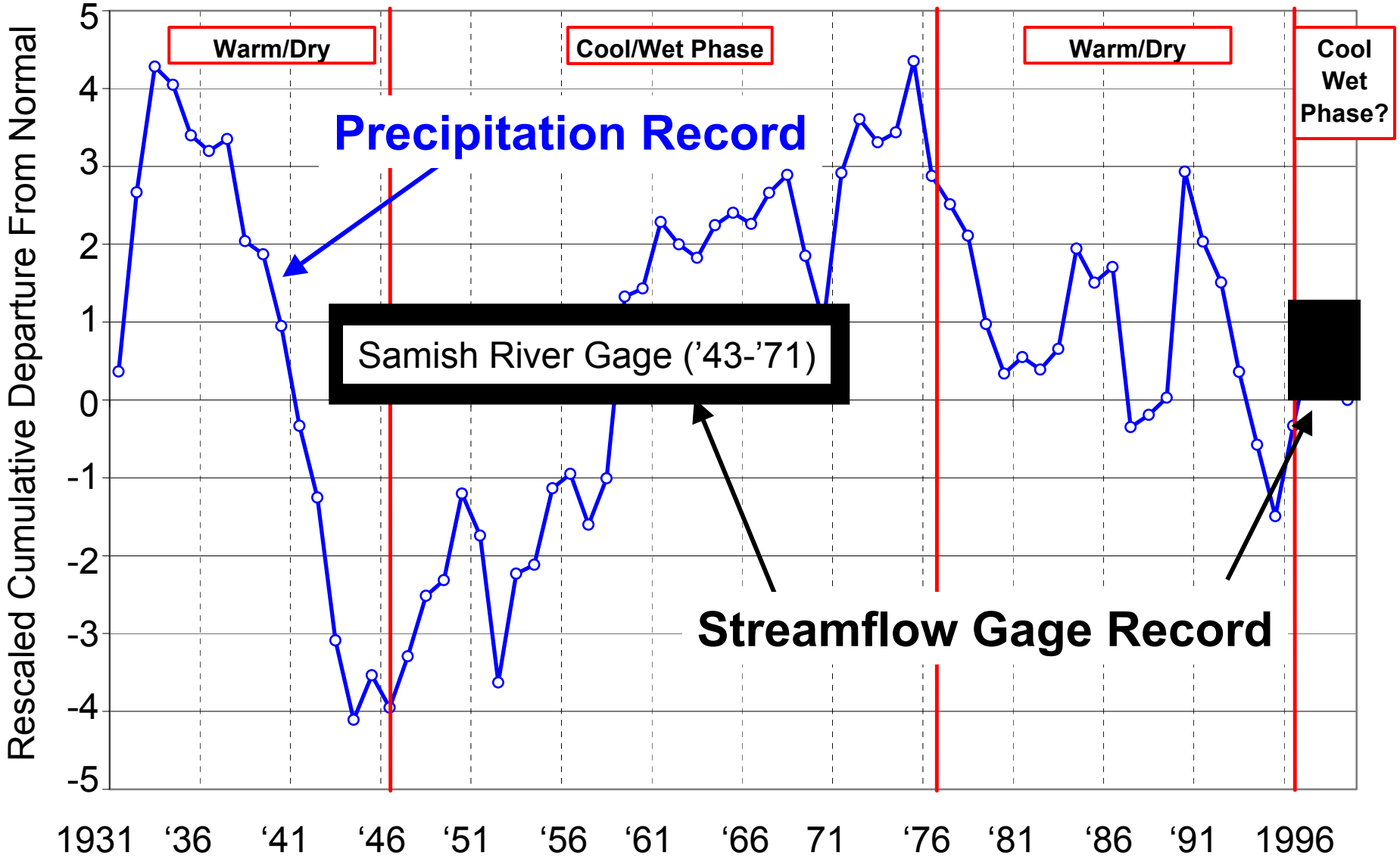
Ground Water Model



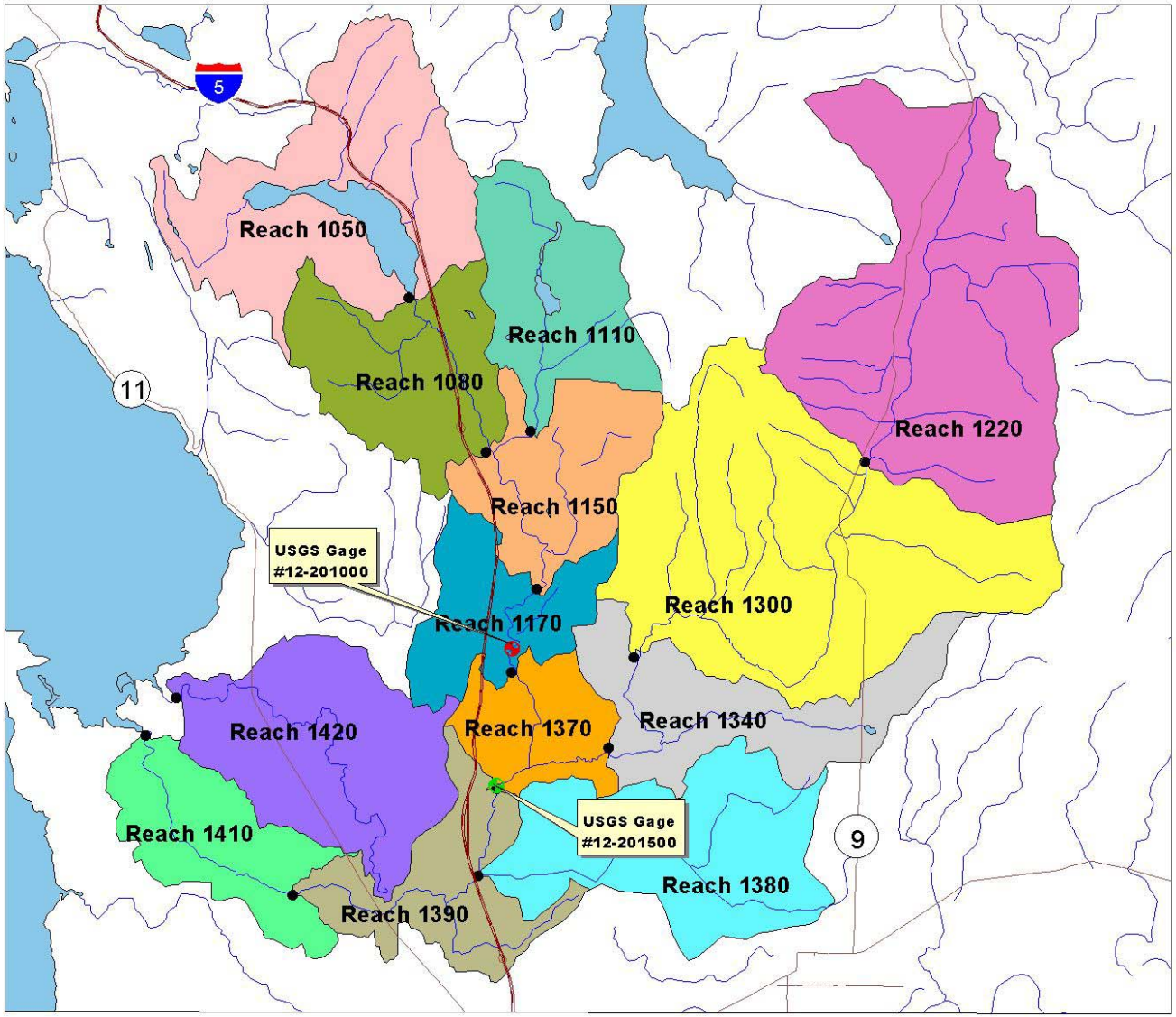
Ground Water Model

- Simulated capture zones and streamflow depletion
- MODFLOW (300 mi.^{2}, 4 layers)

PDO Precip. Cycles and Streamflow Gage Data



Surface Water Model



USGS Stream Gages and Allocation Points

USGS Stream Gages
- Friday Creek
- Samish River

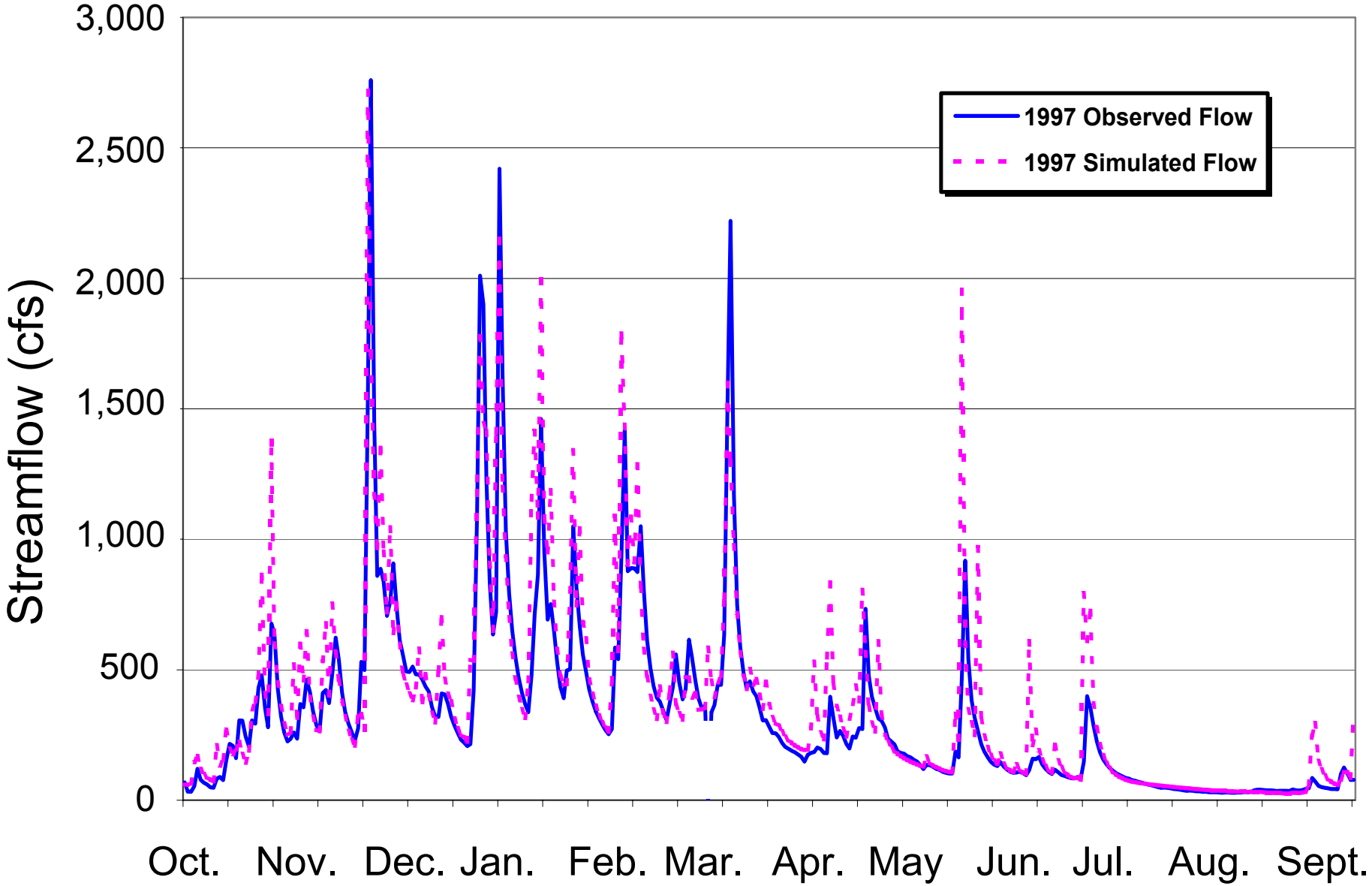
Allocation Points

Allocation Basins
- Lake Samish
- Friday Cr IFIM 3
- Silver Cr IFIM
- Friday Cr IFIM 2
- Friday Cr IFIM 1
- Samish R IFIM 4
- Samish R IFIM 3
- Samish R IFIM 2
- Samish R IFIM 1 (Gage)
- Thomas Creek
- Lower Samish River
- Samish R Outlet
- Edison Slough

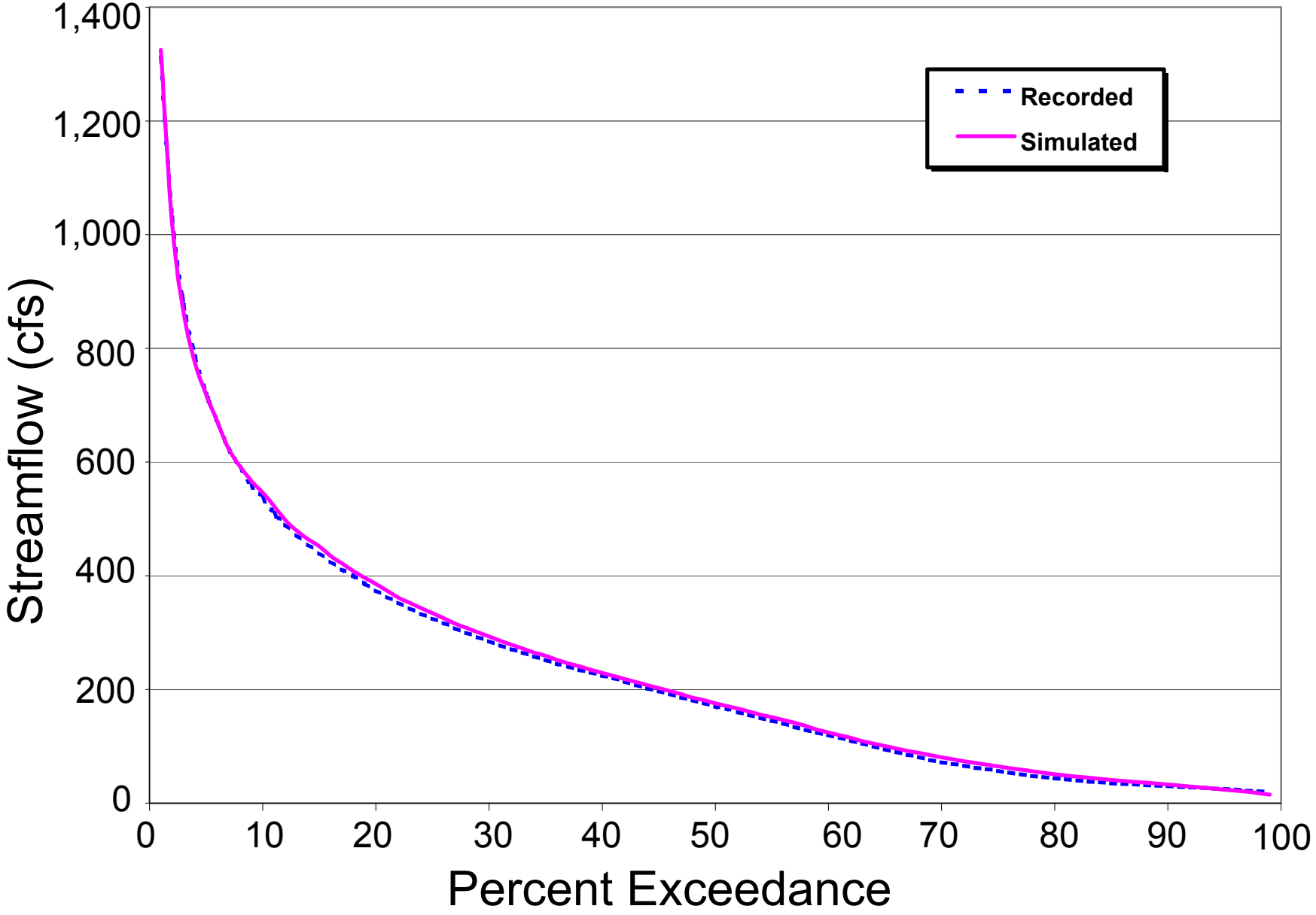
N W E S

3 0 3 Miles

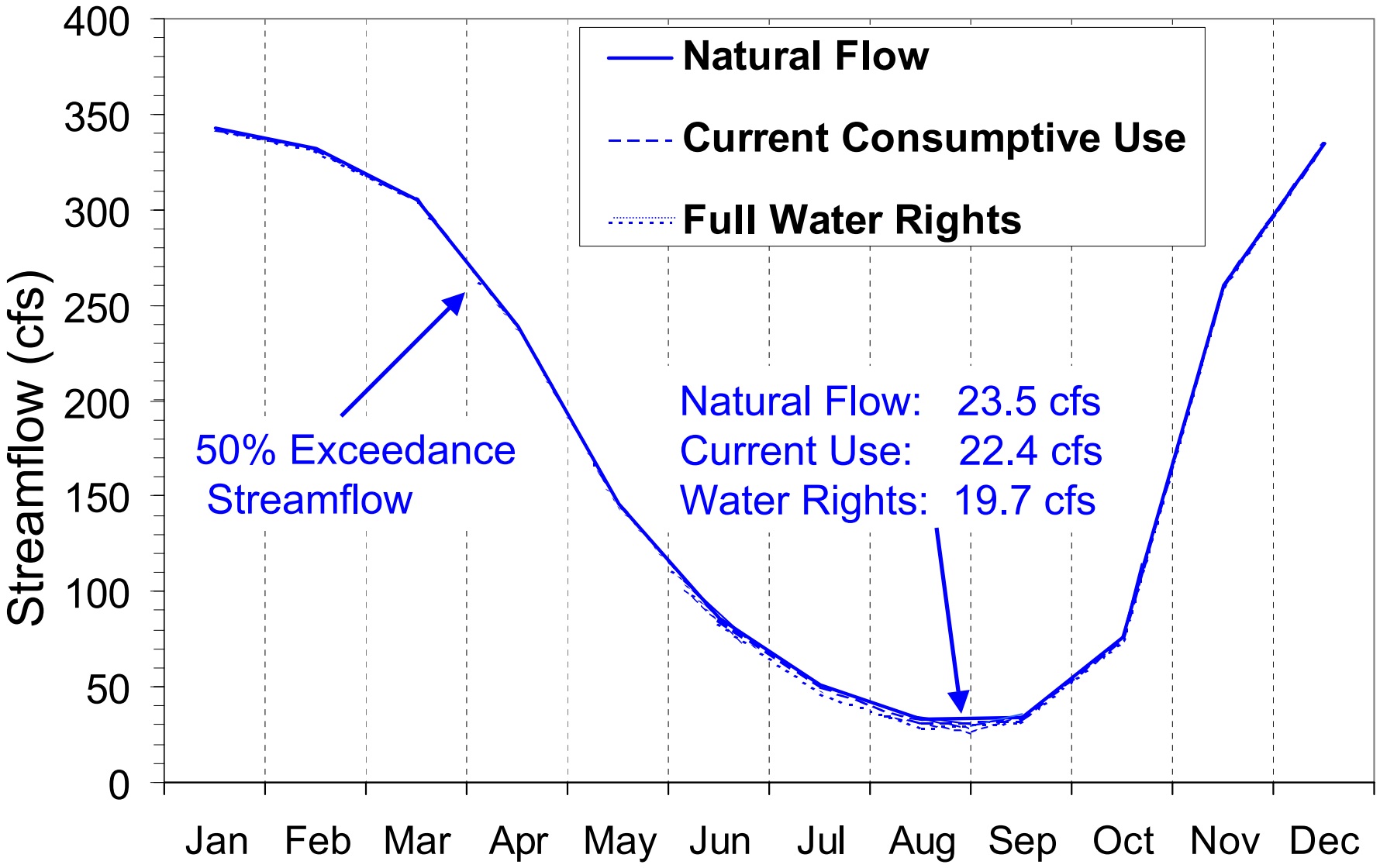
Surface Water Model Calibration



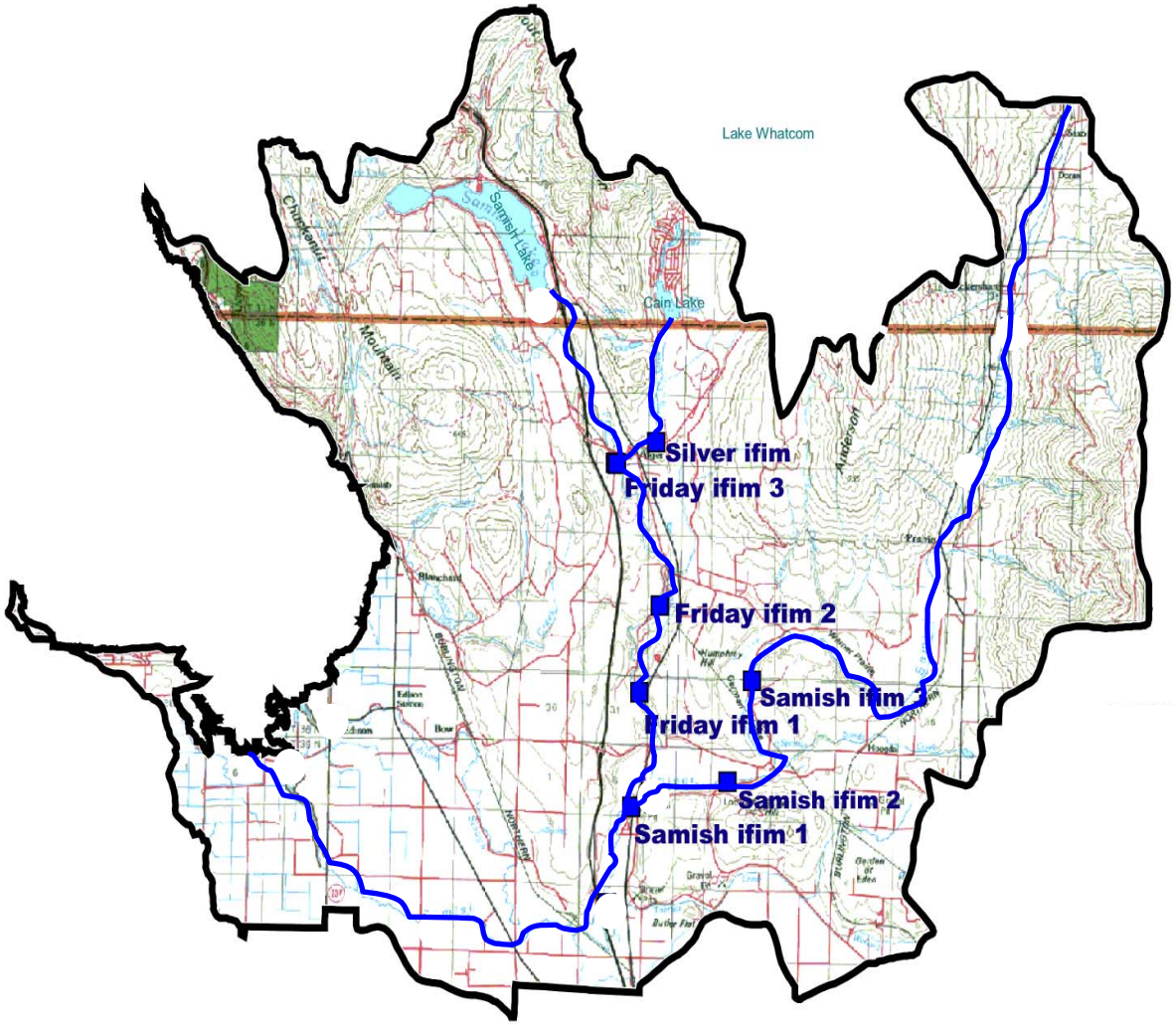
Surface Water Model Calibration



Streamflow Depletion From Water Use

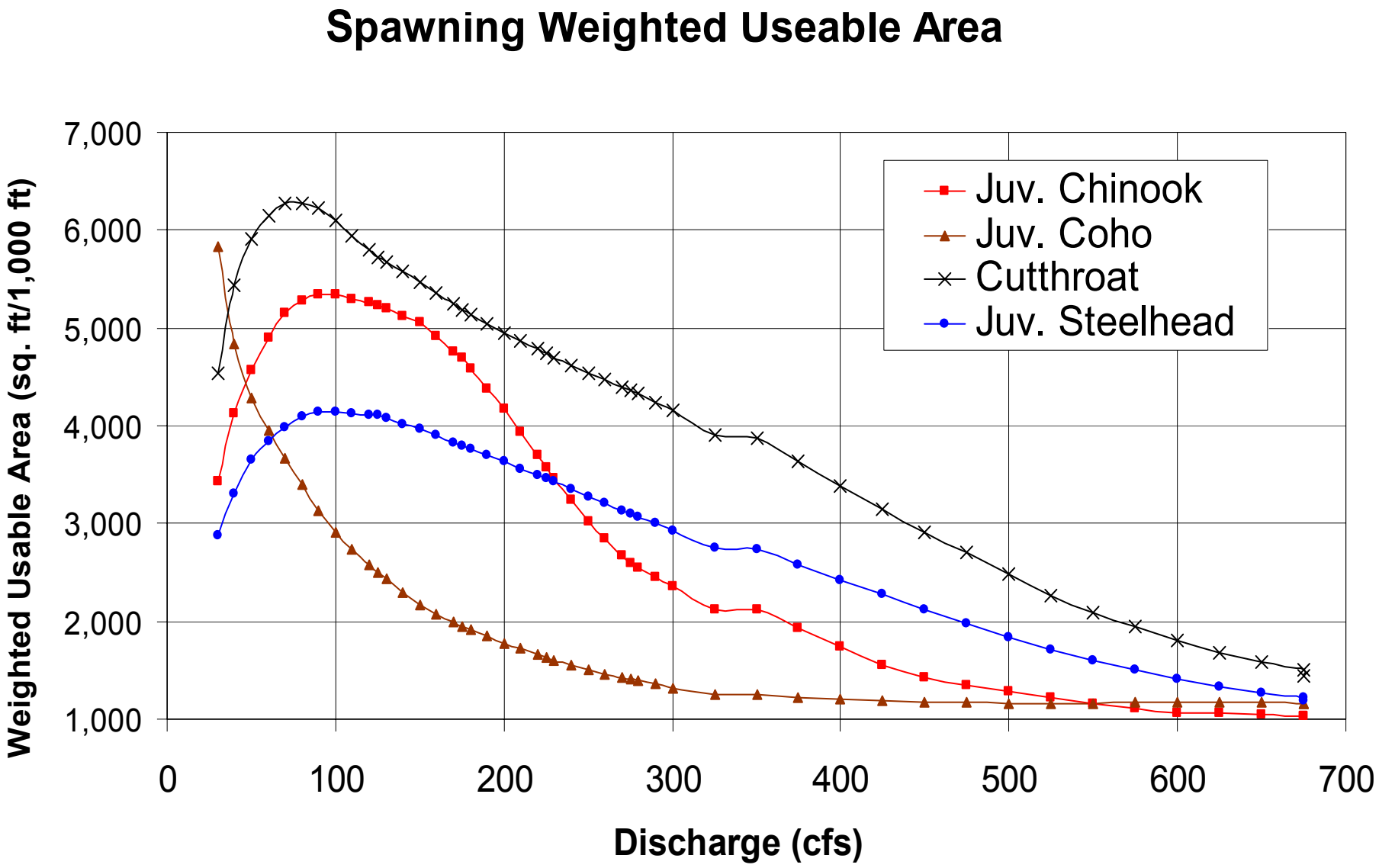


Instream Flow (Fish Habitat) Studies

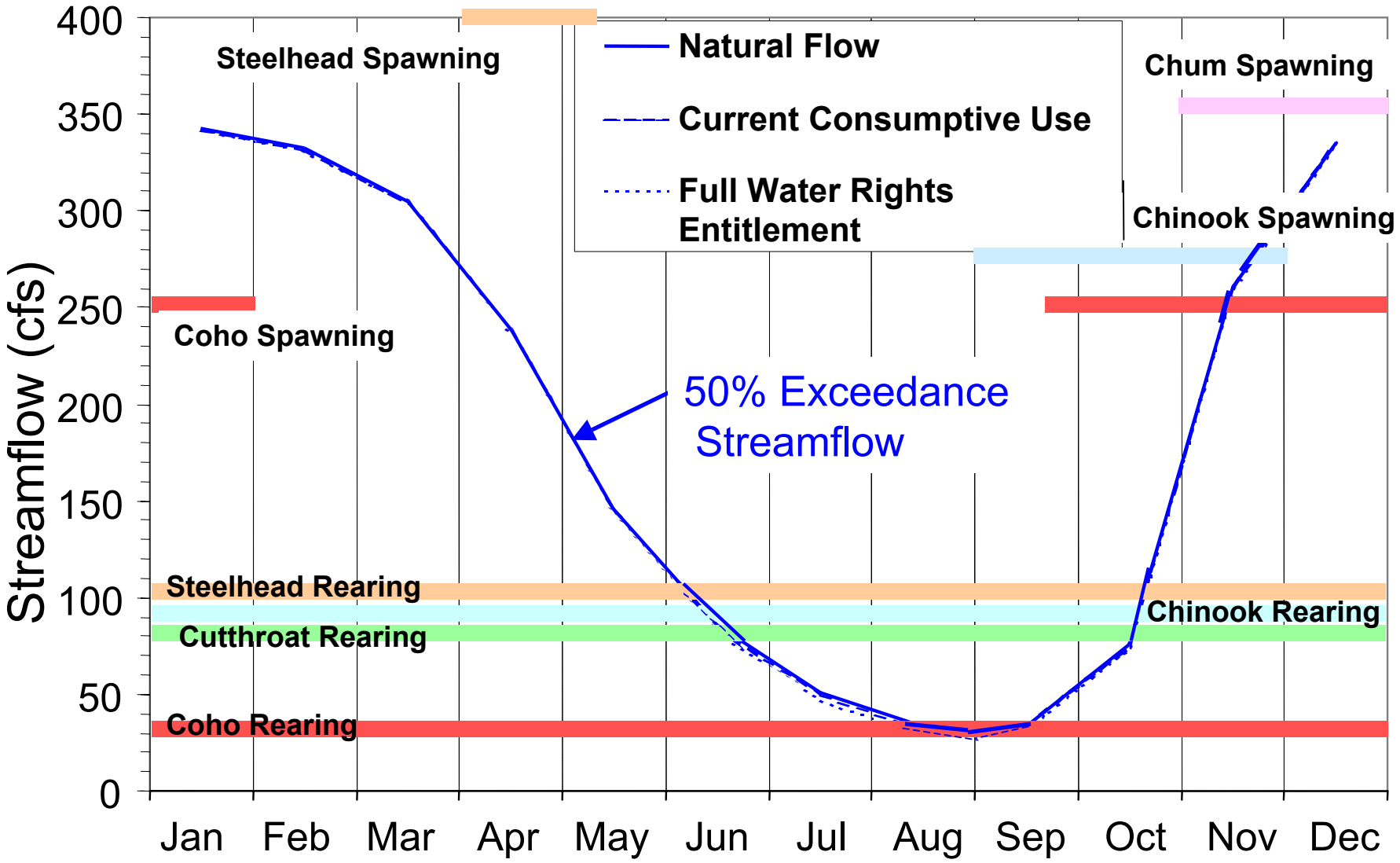


- 7 IFIM sites
- Measured flow max. useable area
  - Low, medium, high discharge
- Surveyed fish species
- Used RHABSIM model to correlate between various flows

Instream Flow (Fish Habitat) Studies



Depleted Streamflow and Optimum Fish Flow



Conclusions

- Current water use in upper basin has maximum of 5% flow reduction.
- Full water rights allocations has maximum of 16% flow reduction.
- Domestic wells have insignificant impact on streamflow.
- Natural streamflow does not meet most “optimum” fish-habitat flow.

Conclusions

- Water management should focus on restoring natural low-flow, not optimal fish-habitat flow.
- Results suggest meeting fish-habitat flow difficult for small sub-basins.
- IFIM process should include natural streamflow variability and water use components (Bovee, 1998).